

Kale-ab Tessera



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ABOUT ME

Kale-ab is a Research Engineer with experience working on challenging theoretical and applied problems in deep learning and reinforcement learning. He considers an excellent work ethic, deep technical knowledge, and his ability to think innovatively as his greatest strengths.

His research interests include Multi-Agent Reinforcement Learning (MARL) (namely scalable coordination or value decomposition) and Deep Learning (specifically Pruning and Generalization).

He is also passionate about using technology to help the African continent. To this end, he has worked on projects that aim to have a high impact in Africa and has also worked on increasing diversity and representation in machine learning by serving on the steering committee of the Deep Learning Indaba.

EXPERIENCE

Research Engineer

[InstaDeep](#)

Johannesburg, South Africa

March, 2021 - Present

Working as a Research Engineer in the Multi-Agent Reinforcement Learning (MARL) research team focusing on cutting-edge scientific research and applications to challenging real-world problems.

Achievements:

- Manage a team of three research engineers and an intern, working on applying MARL to challenging real-world domains.
- First author on “Just-in-time sparsity: Learning dynamic sparsity schedules”, accepted at the Dynamic Neural Networks, ICML Workshop 2022 ([dymn](#)) - [paper](#).
- One of the first authors on Mava, a scalable framework for Multi-Agent Reinforcement Learning - [repo](#), [paper](#) and [blog](#).
- Worked on locust breeding ground prediction for Africa, with two 2021 NeurIPS workshop papers accepted – Artificial Intelligence for Humanitarian Assistance and Disaster Response ([AI+HADR](#)) and Machine Learning for the Developing World ([ML4D](#)) - [repo](#), [paper](#) and [blog](#).

For more details on papers please refer to publications.

Machine Learning Engineer

[Multichoice](#)

Johannesburg, South Africa

Apr 2019 - Feb 2021

Worked on using machine learning to model and predict the behaviour of over 15 million customers.

Achievements:

- Founding member of the ML team in Customer Operations, which grew to be comprised of over 5 people.

- Statistical A /B testing of recommendation systems for movies and tv shows.
- Built a high dimensional clustering model, using DBSCAN, which managed to cluster around 7 million customers, with over 300 features each.
- Built a logistic regression model (with L1 regularization) to predict customer payback behaviour. This model achieved approximately 75% accuracy, outperforming manual predictions and heuristics. This model also outperformed other models such as random forest, SVMs, MLPs and LSTMs.
- Built a public sentiment model, which calculated sentiment based on current media articles.

Intermediate Software Engineer

Johannesburg, South Africa

Entelect

Nov 2017 - March 2019

Built highly scalable, fast, responsive websites for major clients.

Achievements:

- Worked in teams of 10-15 people to build highly responsive websites for large multi-national clients such as [Cell C](#) and [Discovery](#).

Software Engineer

Pretoria, South Africa

RetroRabbit

Jan 2016 - Oct 2017

Built robust backend APIs with multiple system integrations.

Achievements:

- Led a team of 4 and designed the high-level system architecture for a project.
- Solo developer for a highly responsive API, with many integration points. This also involved creating a custom OAuth 2.0 security layer.

EDUCATION

MSc in Computer Science, Focusing on Deep Learning, *Distinction*

Johannesburg, South Africa

University of Witwatersrand

2018–March,2021

- Dissertation (*83%*): “On Sparsity in Deep Learning: The benefits and pitfalls of Sparse Neural Networks and how to learn their architectures” - [link](#).
Lab: [RAIL \(Robotics, Autonomous Intelligence and Learning\)](#).
Supervisor: [Prof. Benjamin Rosman](#)
Collaborators: [Sara Hooker](#)
- Coursework (*85% Average*): Adaptive Computation and Machine Learning, Reinforcement Learning, Robotics, Artificial Intelligence, Large Scale Optimization for Data Science and High Performance Computing.
- Received the Postgraduate Merit Award from the university, Microsoft Prize from the Deep Learning Indaba, and had an accepted paper at the “Sparsity in Neural Networks” workshop titled “[Keep the Gradients Flowing: Using Gradient Flow to study Sparse Network Optimization](#)”.

Honours in Computer Science, *Distinction*

Pretoria, South Africa

University of Pretoria

2016

- Research Report (*82%*): “Automatically Generating Test Cases from Java Contracts”
- Took courses in theoretical computer science such as computer security and formal aspects of computing.
- Received Academic Honorary Colours for academic excellence.

BSc. in Computer Science

Pretoria, South Africa

University of Pretoria

2013–2015

- Took courses in computer science, mathematics, statistics and physics.
- Received an award from Amazon for a final year project on using CNNs to automatically identify different stink bug species, was invited to join the Golden Key Honour Society (top 15% of degree) and received a Merit Certificate for Leadership from the university.
- Teaching Assistant for COS 110 (Program design and Programming techniques) and COS 212 (Data structures and algorithms).

For more information on awards, please see the “Scholarships and Awards” section.

PUBLICATIONS

- [1] K.-a. Tessera, C. Matowe, A. Pretorius, B. Rosman, and S. Hooker, “Just-in-time sparsity: Learning dynamic sparsity schedules”, in *Dynamic Neural Networks, ICML Workshop*, [Paper](#), [Poster](#), [Slides](#), 2022.
- [2] A. Pretorius, K.-a. Tessera, A. P. Smit, C. Formanek, S. J. Grimbley, K. Eloff, S. Danisa, L. Francis, J. Shock, H. Kamper, *et al.*, “Mava: A research framework for distributed multi-agent reinforcement learning”, *arXiv preprint arXiv:2107.01460*, 2021, [Paper](#), [Framework](#), [Blog](#).
- [3] K.-a. Tessera, S. Hooker, and B. Rosman, “Keep the gradients flowing: Using gradient flow to study sparse network optimization”, in *Sparsity in Neural Networks Workshop*, [Paper](#), [Poster](#), [Slides](#), 2021.
- [4] I. S. Yusuf, K.-a. Tessera, T. Tumiel, S. Nevo, and A. Pretorius, “On pseudo-absence generation and machine learning for locust breeding ground prediction in africa”, in *AI + HADR and ML4D NeurIPS Workshops*, [Paper](#), [Blog](#), [Code](#), 2021.

SCHOLARSHIPS AND AWARDS

- **Postgraduate Merit Award**, University of Witwatersrand 2019–2020
An award (with full tuition funding) given to the top postgraduate students, who earn an average above 75%.
- **Microsoft Prize - Best Poster at Deep Learning Indaba**, Deep Learning Indaba 2019
Received the prize for the best research poster at the Deep Learning Indaba. This was the top prize out of 194 presented posters. The prize was a sponsored trip to NeurIPS 2019 in Vancouver.
- **Conference travel scholarships**, Deep Learning Indaba and MLSS 2019
Received a full scholarship to attend Machine Learning Summer School (MLSS) London. This competitive summer school had an 11.75 % acceptance rate (1,200 applicants for 140 places) and of 140 attendees, only 21% were MSc students. Was also awarded a travel grant and accommodation award to attend the Deep Learning Indaba 2019 in Kenya.
- **Academic Honorary Colours**, University of Pretoria 2017
Was awarded Academic Honorary Colours by the University of Pretoria for achieving my honours degree with distinction (Average of 80.75 %).
- **Amazon Prize for Best Mobile Application**, University of Pretoria 2015
Received the team prize for the best mobile application in our final year computer science module (undergraduate). The project involved creating a website and Mobile App that used CNNs to automatically identify and tag different species of stink bugs.
- **Merit Certificate for Leadership**, University of Pretoria 2015
Received this award for leadership for my time as a House Committee member (Head of IT and Communications) at a university residence - Boekenhout.
- **Golden Key Honour Society**, University of Pretoria 2015
Was selected to join the Golden Key Honour Society as an undergraduate for being in the top 15% of my degree.
- **Deputy Head Boy**, PEPPS College 2012
Was selected as deputy-head boy of my school.
- **Matric (Final Year High-School) Academics**, PEPPS College 2012

Notable achievements include being in the Top 1% of IEB IT Matric Students in South Africa and receiving 7 Distinctions with an average of 87%.

RESEARCH PRESENTATIONS, TALKS AND POSTERS

- Presented a talk at Indaba X Ghana titled “Introduction to Deep Reinforcement Learning”- [slides](#). 2022
- Presented the “[Introduction to ML using JAX](#)” and “[Introduction to Reinforcement Learning](#)” practicals at the Deep Learning Indaba to around 500 people. 2022
- Presented a Spotlight talk at the Deep Learning Indaba 2022 - [video](#), [slides](#) and [poster](#). 2022
- Presented a talk at the Indaba X South Africa titled “Playing Starcraft and Saving the World Using Multi-agent Reinforcement Learning”- [video](#), [slides](#) and [notebook](#). 2021
- Presented a talk at Deep Learning: Classics and Trends (DLCT) - [slides](#), [website](#). 2021
- Presented a talk at the Google Brain Sparsity Reading Group - [slides](#). 2021
- Presented a [poster](#) at the Sparse Neural Network [Workshop](#). 2021
- Presented a Spotlight talk at the Deep Learning Indaba 2019 - [video](#), [slides](#) and [poster](#). 2019
- Presentation on Neural Architecture Search for the Robotics, Autonomous Intelligence and Learning lab - [slides](#). 2019
- Presented a poster at MLSS London. 2019.

OPEN SOURCE

- Deep Learning Indaba Practicals 2022 ([GitHub](#)) - A collection of high-quality practicals covering a variety of modern machine learning techniques.
- Mava ([GitHub](#)) - A library of multi-agent reinforcement learning components and systems.
- Pseudo Absence Generation and Locust Prediction ([GitHub](#)) - Locust breeding ground prediction using pseudo-absence generation and machine learning.
- Baobab ([GitHub](#)) - Baobab is an open source multi-tenant web application designed to facilitate the application and selection process for large scale meetings within the machine learning and artificial intelligence communities globally.
- DQN Atari ([GitHub](#)) - Deep Q-Learning (DQN) agent playing pong.
- Robotics Navigation ([GitHub](#)) - A project that compared the navigation ability of two robots (a Turtlebot and a Kuri robot) in challenging dynamic and static environments.
- PRM Path Planning ([GitHub](#)) - Implementation of Probabilistic Roadmaps (PRM) – a path planning algorithm used in Robotics.

See a full list of open source projects on [GitHub](#) or www.kaleabtessera.com/project.

SKILLS

- **ML Frameworks:** JAX, TensorFlow 2+, Keras, Scikit-learn, Pytorch, Deepmind’s Acme, Deepmind’s Reverb.
- **Programming:** Python, JavaScript (React), C/C++.
- **Distributed ML:** Ray, Pyspark, Deepmind’s Launchpad.
- **Tools/Cloud:** LaTeX, Git, Docker, Linux, Amazon AWS, Google GCP.

VOLUNTEERING, ORGANIZING AND REVIEWING

- Africa to Silicon Valley Educator 2022 - Present
Teaching an “Introduction to Machine Learning” Course to talented African students at [Africa to Silicon Valley](#).
- Deep Learning Indaba Steering Committee 2022 - Present

Serving on the steering committee for the [Deep Learning Indaba](#). The Indaba is an organisation whose mission is to Strengthen Machine Learning and Artificial Intelligence in Africa.

- One of the organizers of the ML Efficiency Workshop 2022
One of the organizers of the [ML Efficiency](#) Workshop at the Deep Learning Indaba in 2022.
- Practicals Committee Chair 2022
Chair of the [Practicals](#) Committee for the 2022 Deep Learning Indaba. Developed the “[Introduction to ML using JAX](#)” practical and helped develop the “[Introduction to Reinforcement Learning](#)” practical.
- Deep Learning Indaba Mentorship Committee 2021 - Present
Part of the team that launched the [Deep Learning Indaba Mentorship Programme](#).
- Deep Learning Indaba Baobab Committee 2020
Part of the committee making decisions relating to improvements to Baobab - the current applications website.
- Deep Learning Indaba Application and Selection Committee 2020
Part of the committee making decisions relating to improvements to the Indaba applications and selections process.
- Black in AI Paper Reviewer 2017, 2018
Reviewed papers focused broadly on Machine Learning for [Black in AI](#).

HOBBIES AND INTERESTS

Climbing, running, chess, tennis, football, and learning new things.